PRELIMINARY DRAFT
FOR DISCUSSION PURPOSES ONLY

RICONDO & ASSOCIATES, INC.

DISCUSSION OUTLINE

JUNE 25, 2002

Prepared for
City of Chicago Department of Aviation

Ricondo & Associates, Inc.

PRELIMINARY DRAFT
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AGENDA

I. INTRODUCTION

II. SIMULATION MODELLING

III. AIRFIELD REFINEMENTS

IV. PROPOSED AIRFIELD REFINEMENTS UNDER REVIEW

V. NEXT STEPS

I. INTRODUCTION

II. SIMULATION MODELLING

1. ORD ATCT assumptions received for Options 1 and 5.

2. Chicago TRACON assumptions received for Option 1.

3. ORD ATCT reviewed Option 1 animation on 06/19/2002. Comments received and being acted upon. Further reviews and comments to follow.

4. Plan X calibration experiment reviewed and accepted by MITRE.

5. IFR calibration experiment and Plan W to be reviewed this week by ATC. Upon successful review, these experiments will be sent to MITRE for further review.

6. Initial ATC review of CATII/III IFR experiments to occur this week.

7. Planning Activity Level (PAL) 2 schedule being pre-processed for input into Options 1, 2 and 5.

III. AIRFIELD REFINEMENTS

1. Taxiways were provided to facilitate intersection departures (Option 5).

2. East end of Runway 28R (Option 5) to remain in its existing location

   This runway was originally shown as a 12,000-foot runway based on preliminary information from the airlines on runway length requirements. The airlines have since conducted detailed analyses that have concluded a requirement for 12,250 feet of runway length for "long-haul" Asian market departures. A modification to Option 5 has been made that maintains the existing east end location of Runway 9R-27L (Future 10L-28R) and extends the runway to the west to co-locate the thresholds of Runway's 10L and 10C with a resultant runway length of 13,000 feet and preserves the existing max length runway.

IV. PROPOSED AIRFIELD REFINEMENTS UNDER REVIEW

1. Limit GROUP VI Airport Design to specified taxiways and runways as practical

   The concepts developed/presented thus far are designed to meet FAA Design Group VI requirements for pavement width and distance between centerlines.

   - 200' wide runways
   - 100' wide taxiways
   - 600' runway-to-taxiway spacing
   - 324' taxiway-to-taxiway spacing

   The existing central terminal area and surrounding taxiways, however, has remained essentially Group V capable only.

   Subsequent fleet mix analysis has indicated the above design premise might be overly aggressive, in terms of capability and cost. Additional airfield planning has been done to consider only partial Group VI requirements. This approach would increase the available area for airport support functions (i.e., hangars, cargo facilities, etc.). Initial thinking, along these revised guidelines, suggested the south airfield would be more suitable to be designed to Group VI guidelines given the existing terminal area essentially "opens" to the south. On this basis, Group VI aircraft could enter the terminal area via the crossover taxiways and thereby avoid substandard (for Group VI) spacing between the inner and outer taxiways surrounding the terminal area. However, it was determined that it would be desirable to have one runway on the north airfield Group VI capable (preferably Runway 9C-27C of Option 5). This would avoid the problem of a Group VI aircraft departing from the south set of parallel runways destined to a north fix that would need to cross in the airspace to establish their normal track and thereby essentially close the airspace for north airfield departures for some time.

   The OMP Team has developed preliminary Group VI taxi flows consistent with the recently submitted taxi flow diagrams for Option 5 by the FAA Tower. These taxi flows show that an A380 could takeoff and land on Runways 10L-28R and 10C-28C of the south airfield and Runway 9C-27C of the north airfield. Points of congestion and/or conflict are noted on the particular exhibit, as described below. In many cases the normal prescribed taxi flow would need to be deviated because of access restrictions into the existing terminal area.

- **Exhibit IV-1** depicts anticipated taxi routes for west flow operations during VFR conditions. Group VI landing on Runway 27C would require crossing Runways 27L and 28R and using a parallel taxiway north of Runway 28C before reaching International Terminal Building. As highlighted by a set of green lines, the taxiways between the main terminal area and Runway 28R are only designed for group V aircraft. Other relevant issues include:

    - Runways 27C and 28R are used for arrivals and Runways 27L and 28C for departing aircraft.
    - LAHSO is in effect on the two arrival runways during VFR to facilitate traffic flow for departing aircraft beyond LAHSO.
    - Aircraft arriving on Runway 27C would use the inner parallel taxiway, and except for group VI aircraft, runway crossing would only be permitted beyond LAHSO or the Runway 27C end.
    - Departing aircraft on Runway 27L would use intersection departures to facilitate runway crossing for arrivals. Group VI aircraft would require crossing the runway and using the north parallel runway (between 27C and 27L) for departures.
    - Departing aircraft on Runway 28C would require to cross Runway 28R beyond the designated LAHSO and use the south parallel (between Runways 28L and 28C).
    - Potential congestion exists between 27C and 27L for Group VI aircraft requiring crossing the runways for both arrivals and departures.

- **Exhibit IV-2** depicts anticipated taxi routes for west flow operations during IFR conditions during which Runways 27C and 28C are used for arrivals and Runways 27L and 28R for departing aircraft. With the outer runways used for arrivals, LAHSO is in not in effect during IFR operations. Operations in the north airfield are similar to the previous condition except for LAHSO not being in effect.

    - Arriving aircraft on Runway 28C would use the south parallel runway in easterly direction to bypass Runway 28R before reaching the terminal area. The travel time would be higher for these aircraft compared to aircraft arriving on 27C.
    - Departing aircraft on Runway 28R would use intersection departures allowing for arriving aircraft to taxi beyond the departing aircraft.

  - Group VI taxi in and taxi out flows would be similar to operations during VFR conditions. However, runway crossing would increase on Runway 28R as both arriving and departing aircraft would need to cross the runway.

- **Exhibit IV-3** shows anticipated taxi routes for east flow operations during VFR conditions. Runways 9C and 10L are used for arrivals and Runways 9R and 10C for departing aircraft. LAHSO is in effect on Runway 10L during VFR to facilitate the traffic flow for departing aircraft on Runway 10C.

  - Aircraft arriving on Runway 9C would use the inner parallel taxiway and cross Runway 9R at the west end to reach the terminal maneuvering area.
  - Departing aircraft on Runway 9R would use intersection departure to fully segregate taxi-in and taxi-out flow on the two runways. No special treatment of Group VI aircraft would be required for operations in the north airfield based on the planned taxi flows.
  - Departing aircraft on Runway 10C would cross Runway 10L beyond the designated LAHSO and use the south parallel to depart from the runway end.
  - Group VI landing on 9C would require crossing both Runways 10C and 10L and use the parallel taxiway south of Runway 10C before reaching International Terminal Building.
  - Potential congestion exists at the ends of Runway 10L-28R and Runway 10C-28C due mainly because of runway crossings required for group VI aircraft.

- **Exhibit IV-4** illustrates anticipated taxi routes for the east traffic flow of operations during IFR conditions. Runways 27C and 28C are used for arrivals and Runways 27L and 28R for departing aircraft. With outer runways used for arrivals, LAHSO is in not in effect during IFR operations.

  - Operations in the north airfield are similar to the previous condition except for LAHSO not being in effect.
  - Arriving aircraft on Runway 28C would use the south parallel taxiway (between 28C and 28R) in the easterly direction to bypass Runway 28R before reaching the terminal area. The travel time would be significantly higher for these aircraft

compared to aircraft arriving on 27C.

- Departing aircraft on Runway 28R would use intersection departures allowing for arriving aircraft to taxi beyond the departing aircraft.
- Group VI taxi in and taxi out flows would be similar to operations during VFR conditions. However, runway crossing would increase on Runway 28R as both arriving and departing aircraft would need to cross the runway.

2. ATCT Line of Site to far north and far south runways.

The existing Airport Traffic Control Tower (ATCT) has an overall elevation of 910 feet MSL (per current O.C. Chart) with a corresponding controller eye height of 884.5 feet MSL, or 25.5 feet beneath the top of the tower, including its appendages. **Exhibit IV-5** illustrates the line-of-sight requirements to maintain controller vision to the parallel taxiways of Runway 9L-27R and Runway 10R-28L of Option 5. Also shown on the exhibit is the shadowing impact of the existing UA Service Center and AA hangar on the north airfield as well as the impact of the south tier of cargo buildings on the south airfield.

A review of Exhibit 4-5 shows the line-of-sight shadow established by the AA Hangar crosses the north runway and its parallel taxiway, with the shadowing impact of the UA Service Center considerably greater in that the entire approach end of Runway 9L is shadowed. The shadow of the Service Center extends approximately 8,200 feet beyond the centerline of the runway with a maximum height of the shadow over the centerline of 94.5 feet.

A review of missed approach surfaces shows the controlling elevation over the existing ATCT site is governed by the existing Runway 27L CAT I missed approach with a elevation over the site of 921.6 feet MSL. On this basis, the existing ATCT eye height could technically be raised another 11.6 feet if the same ratio of 25.5 feet below tower elevation could be maintained (i.e., a controller eye elevation of 896.1 ft. MSL). Analysis has indicated raising the eye height by 11.6 feet would shorten the length of the UA Service Center beyond the runway centerline to 7,140 feet with a corresponding reduction in shadow height over centerline to 91.5 feet. On this basis, raising the eye height by 11.6 feet has a negligible positive impact in reducing the impact of the shadowing.

Not knowing whether removal of the ASDE antenna from atop the ATCT is a viable option, analysis was performed to establish the shadowing impact improvement if the controller eye height were to correspond to the maximum ATCT height value of 921.6 feet MSL.

While such an option is technically not feasible (i.e., some structure for enclosure is necessary above any raised vantage point), it was none-the-less calculated for trend purposes. At a controller eye level elevation of 921.6 feet MSL the length of the UA Service Center shadow beyond the runway centerline would be reduced to 5,428 feet and the height of the shadow above the runway centerline would be reduced to 84.9 feet.

3. Perimeter T/W usage/restrictions in Option's 1 and 2 - Airport drawings of Option 2 have been submitted to FAA for review and comment on the use of perimeter taxiways.

4. Runway 22R extension (proposed only under north airfield relocation) - Required to maintain Land and Hold Short Operations (LAHSO) ONLY IF existing Runway 9L-27R is moved north to provide dual taxiway design.

5. Runway 22L extension

   In today's environment the FAA ATCT indicates the capacity to conduct 44 departure operations per hour on Runway 22L while arriving 40 aircraft on existing Runway 27L. In essence, the opportunity exists for one aircraft to depart behind each arrival and two to depart behind each B757 or heavy jet. Under constant demand the arrival interval on Runway 27L varies from 2.5NM or approximately 75 seconds to 6NM or approximately 180 seconds depending on the weight class of the preceding aircraft (Illustrated in **Exhibit IV-6**). As the predominate fleet mix is consistent with the use of the 2.5NM separation standard, the majority of interval fall within the 75 second range. When considering the indicated capacity on an unimpeded runway to be 50 departures per hour, an average interval of 72 seconds, as well as the inability to fan departures on one of the most used configurations (Plan W); and weight class separation, there seems to be little opportunity to increase departure capacity by extending Runway 22L.

6. Install CAT II/III instrumentation where practical

   An assessment of CAT II/III weather occurrences was performed to assess the need for CAT II/III capabilities on runways other than Runway 9-27. The results of this assessment are depicted in Exhibit IV-7 and IV-8.

Exhibit IV-7 presents the percent CAT II (ceiling less than200 ft. and greater than 100 ft., visibility less than ½ mile and greater than ¼ mile) weather coverage provided by Runway 9-27, Runway 4, and Runway 22 under various allowable crosswind components. In the ten-year analysis period, 478 hourly observations of CAT II weather occurred. As shown, Runway 9-27 provides over 97% coverage for these conditions for allowable crosswind component categories of 13 knots and above. The current Runway 14 CAT II approach provides coverage of 78%, 83%, 87%, and 89% for allowable crosswind components of 10.5 kts, 13 kts, 16 kts, and 20 kts, respectively.

Exhibit IV-8 presents the percent CAT III (ceiling less than 100 ft., visibility less than ¼ mile) weather coverage provided by Runway 9-27, Runway 4, and Runway 22 under various allowable crosswind components. In the ten-year analysis period, 287 hourly observations of CAT III weather occurred. As shown, Runway 9-27 provides over 98% coverage for these conditions for allowable crosswind component categories of 13 knots and above. The current Runway 14 CAT III approach provides coverages of 79%, 87%, 91%, and 91% for allowable crosswind components of 10.5 kts, 13 kts, 16 kts, and 20 kts, respectively. Considering the extent of coverage provided by Runway 9-27, and the limited benefit provided by Runway 4-22 during these conditions, it is proposed to provide CAT II/III capability on Runway 9-27 only.

7. Runway 9C-27C (Option 5) extend to the east as shown in Options 2, 5

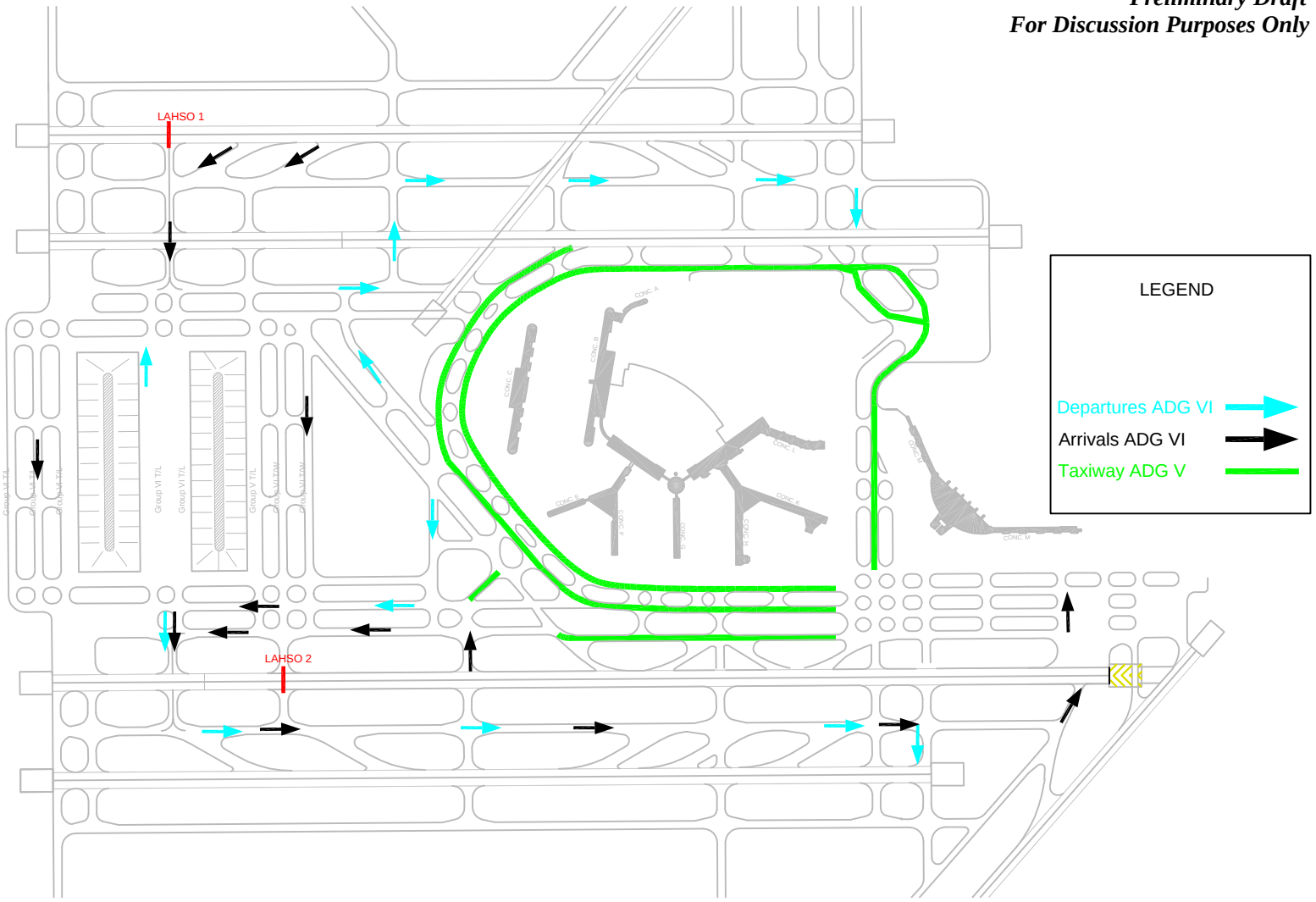
   This runway was reduced in Option 5 when it was assumed that this would primarily be an arrival runway. However, the ATCT have provided input to Option 5 with configurations that will use Runway 9C-27C as a departure runway during IMC. Additionally, aircraft would depart the runway from an intersecting departure such that aircraft to/from Runway 9L-27R could cross behind the departing aircraft on Runway 10C-28C. For these reasons, the ATCT has suggested that the length of Runway 9C-27C be extended to 11,245 feet as shown in Option 2.

8. Dual T/W system on north airfield inner core

   Option 3, Dual T/W on the north airfield, was identified as an option for a second round of simulations pending results of the simulation analyses currently underway. Initial work performed to date on Options 1 and 5 do not suggest an operational need for the dual taxiway system north of the terminal area.

9. Reduce taxiway to runway separations on far north/south runways for landside development.

V. NEXT STEPS



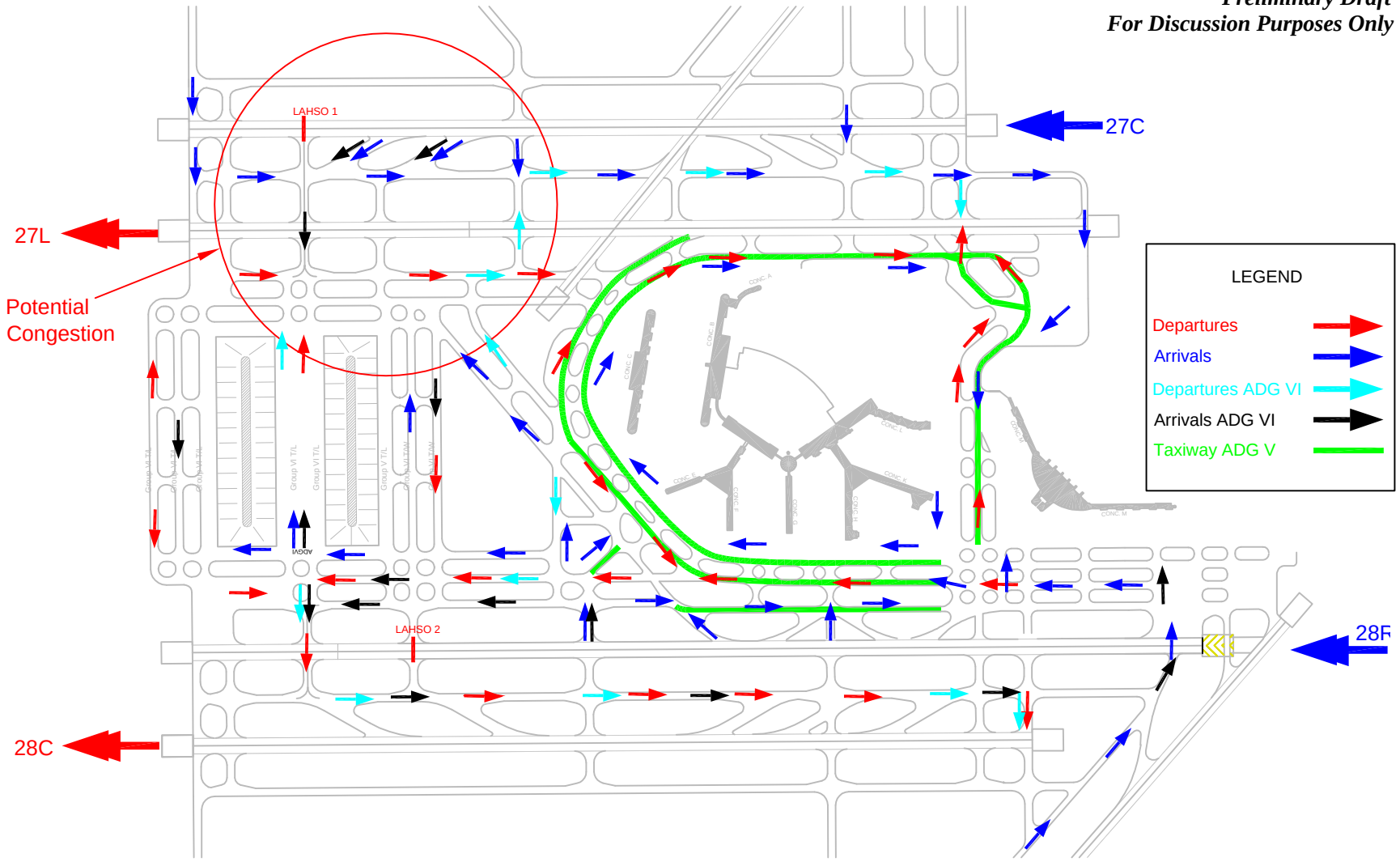
Source: O'Hare Air Traffic Control Tower and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

Exhibit IV-1

0 2000
north

VFR-West-Flow.dwg

VFR WEST FLOW



Source: O'Hare Air Traffic Control Tower and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

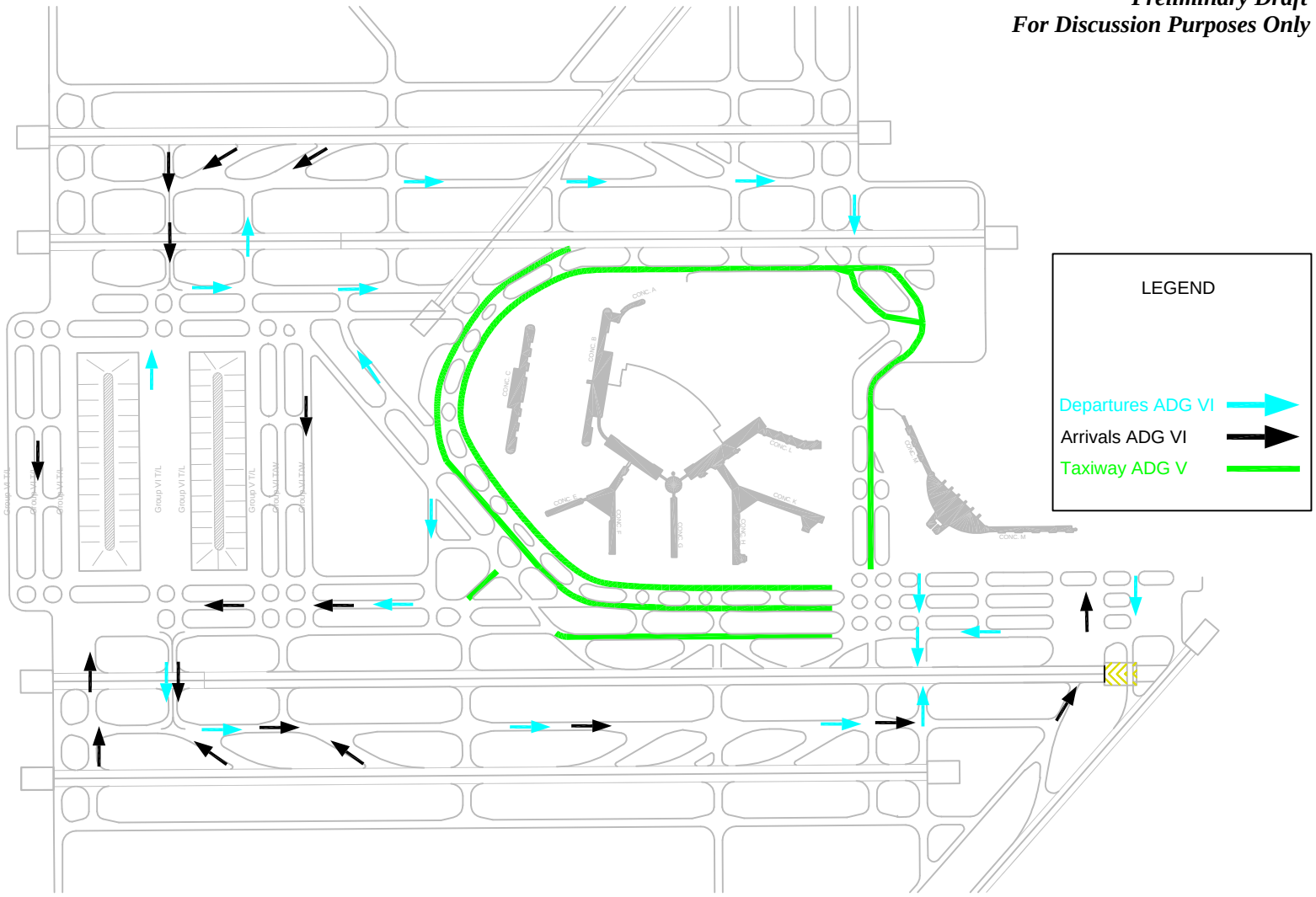
Exhibit IV-1A

0 2000

north

VFR-West-Flow.dwg

VFR WEST FLOW



Source: O'Hare Air Traffic Control Tower and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

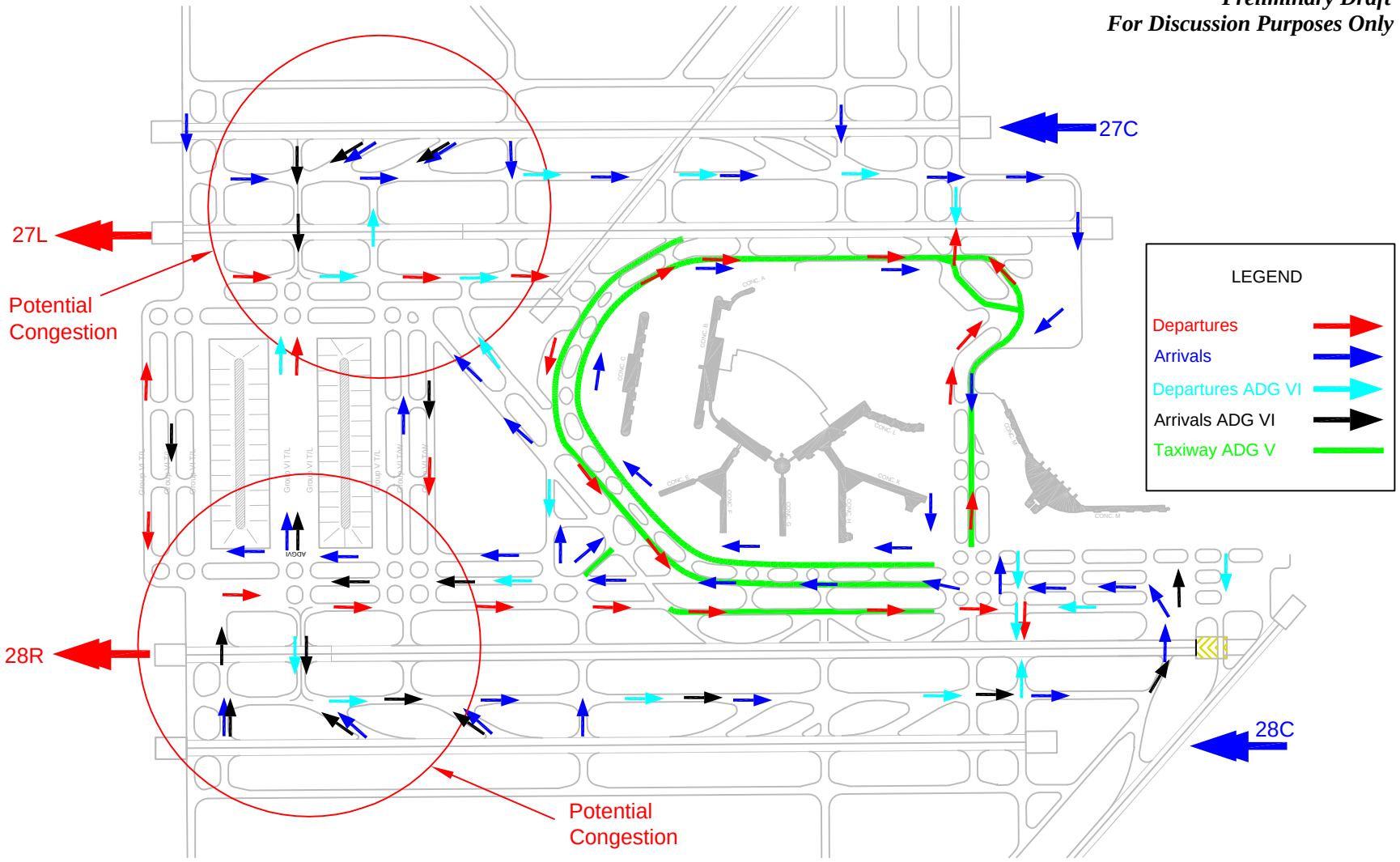
Exhibit IV-2

0 2000

north

VFR-West-Flow.dwg

IFR WEST FLOW



Source: O'Hare Air Traffic Control Tower and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

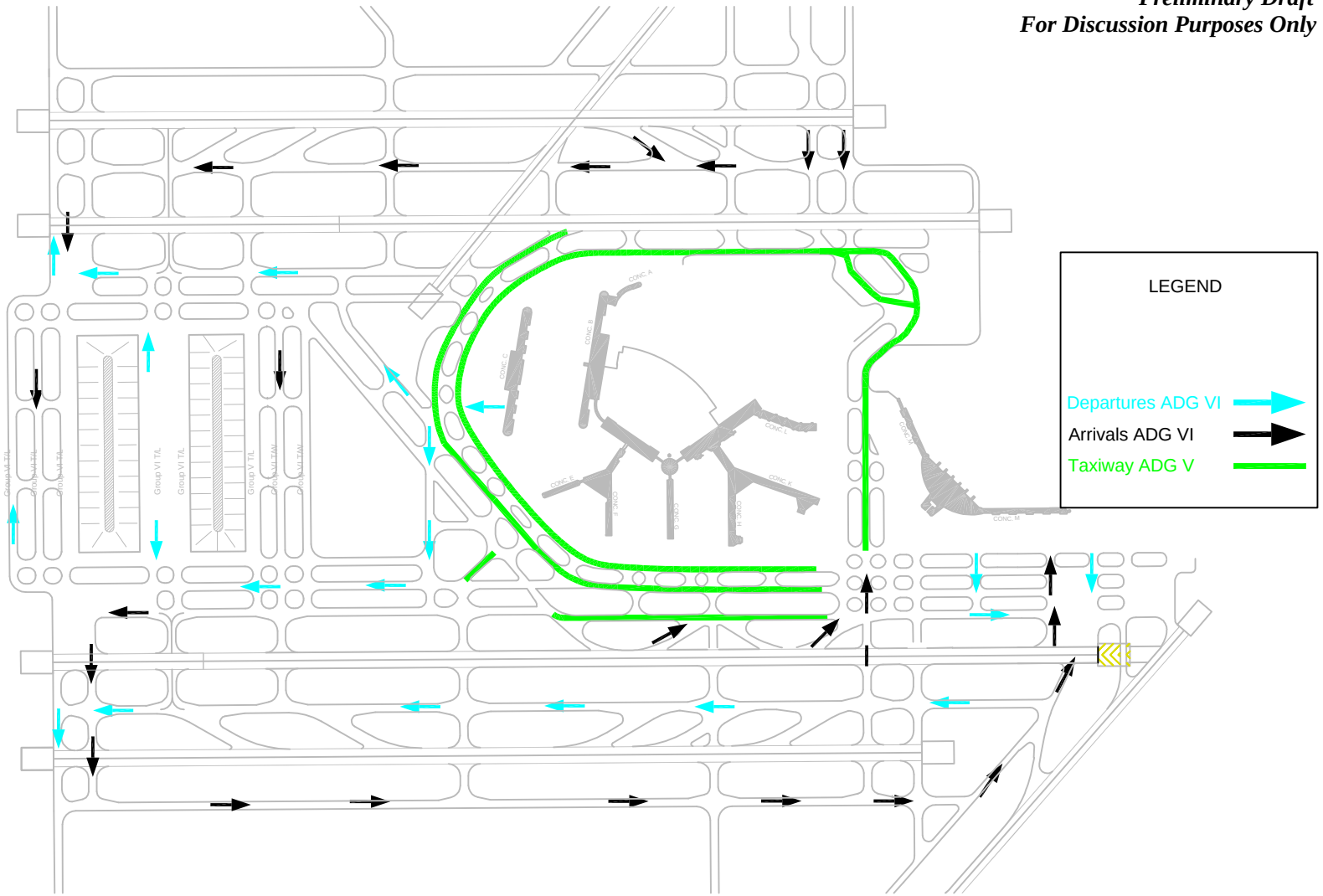
Exhibit IV-2A

0 2000

north

VFR-West-Flow.dwg

IFR WEST FLOW



Source: O'Hare Air Traffic Control Tower and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

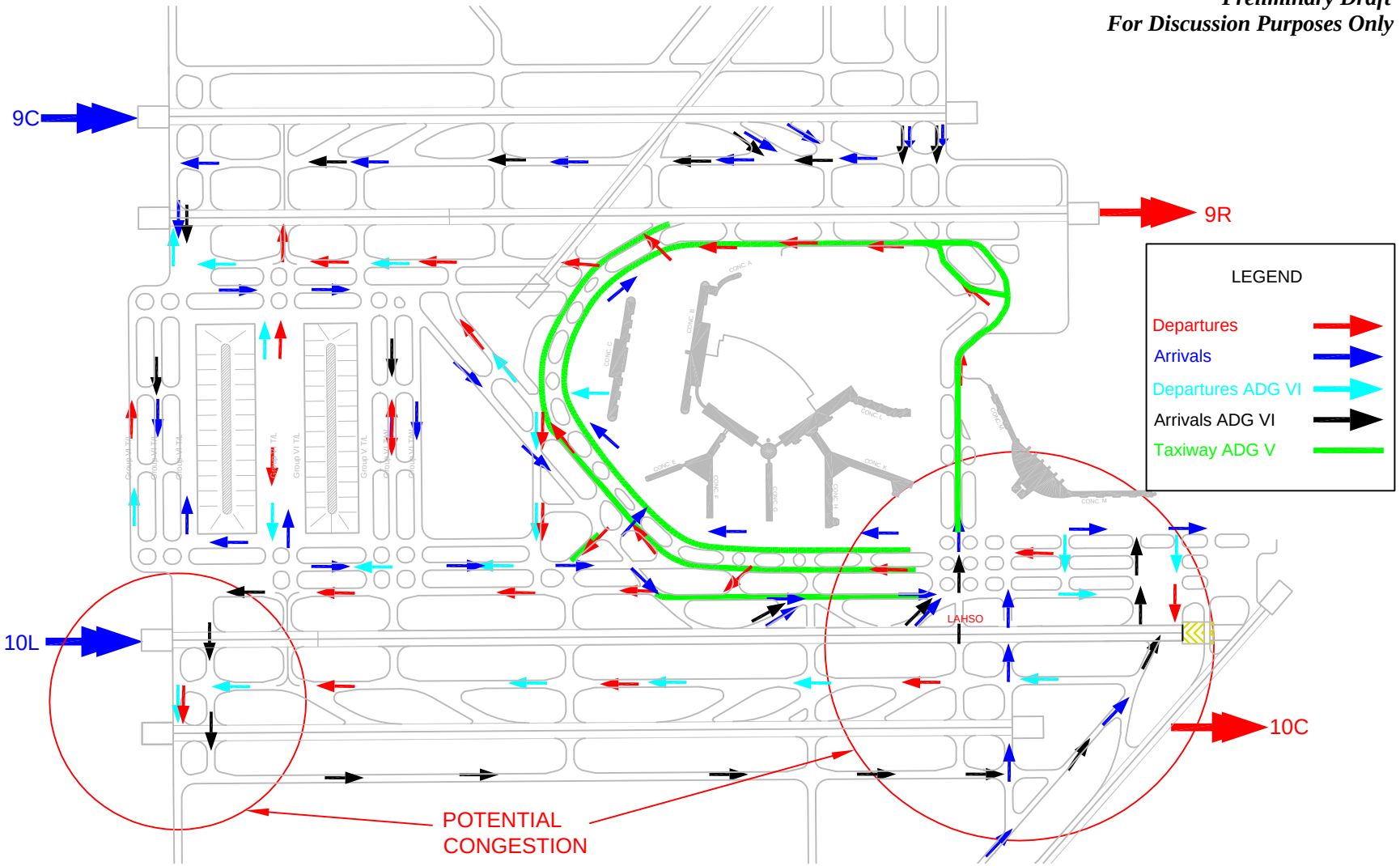
Exhibit IV-3

0 2000

north

VFR-East-Flow.dwg

VFR EAST FLOW



Source: O'Hare Air Traffic Control Tower and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

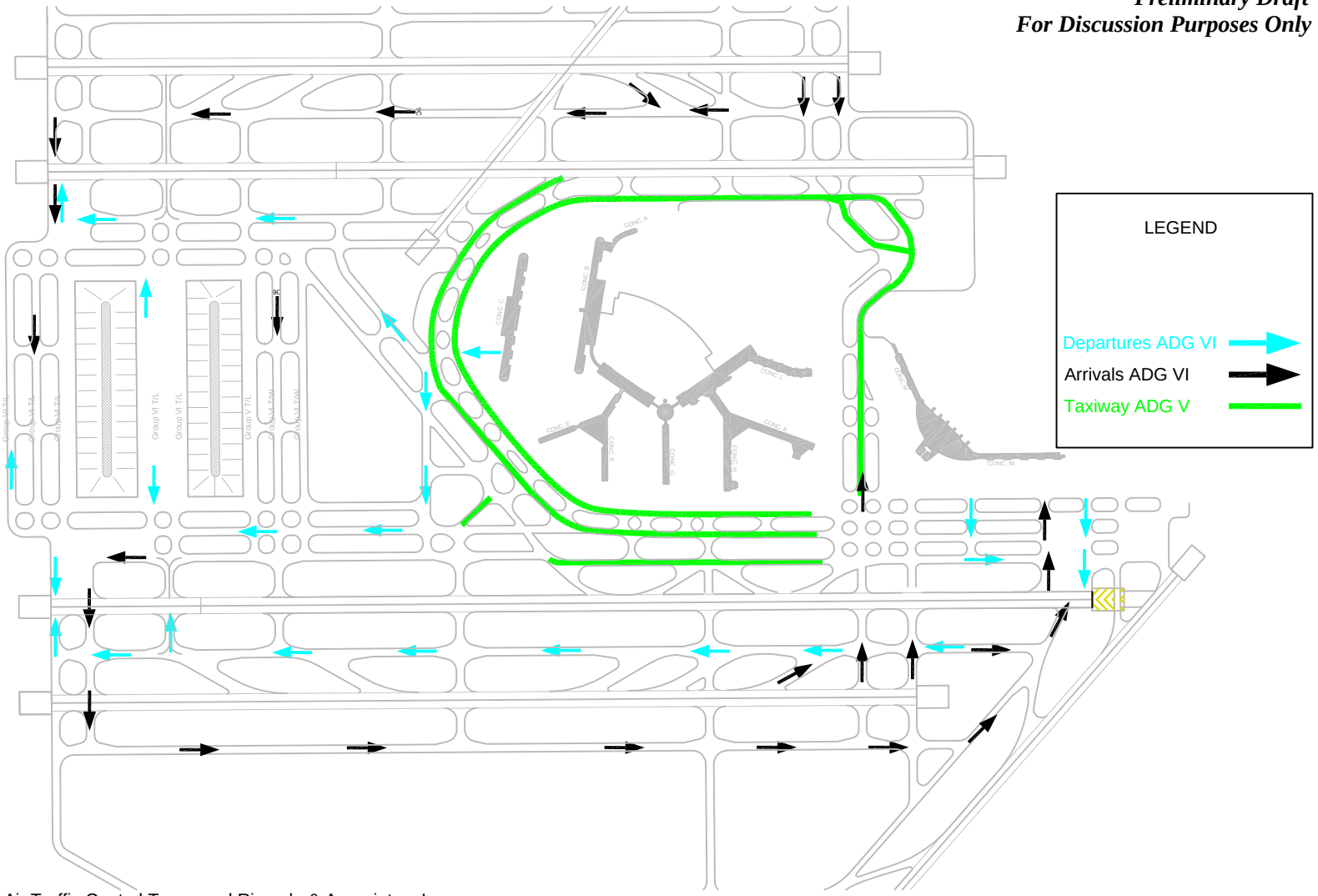
Exhibit IV-3A

0 2000

north

VFR-East-Flow.dwg

VFR EAST FLOW



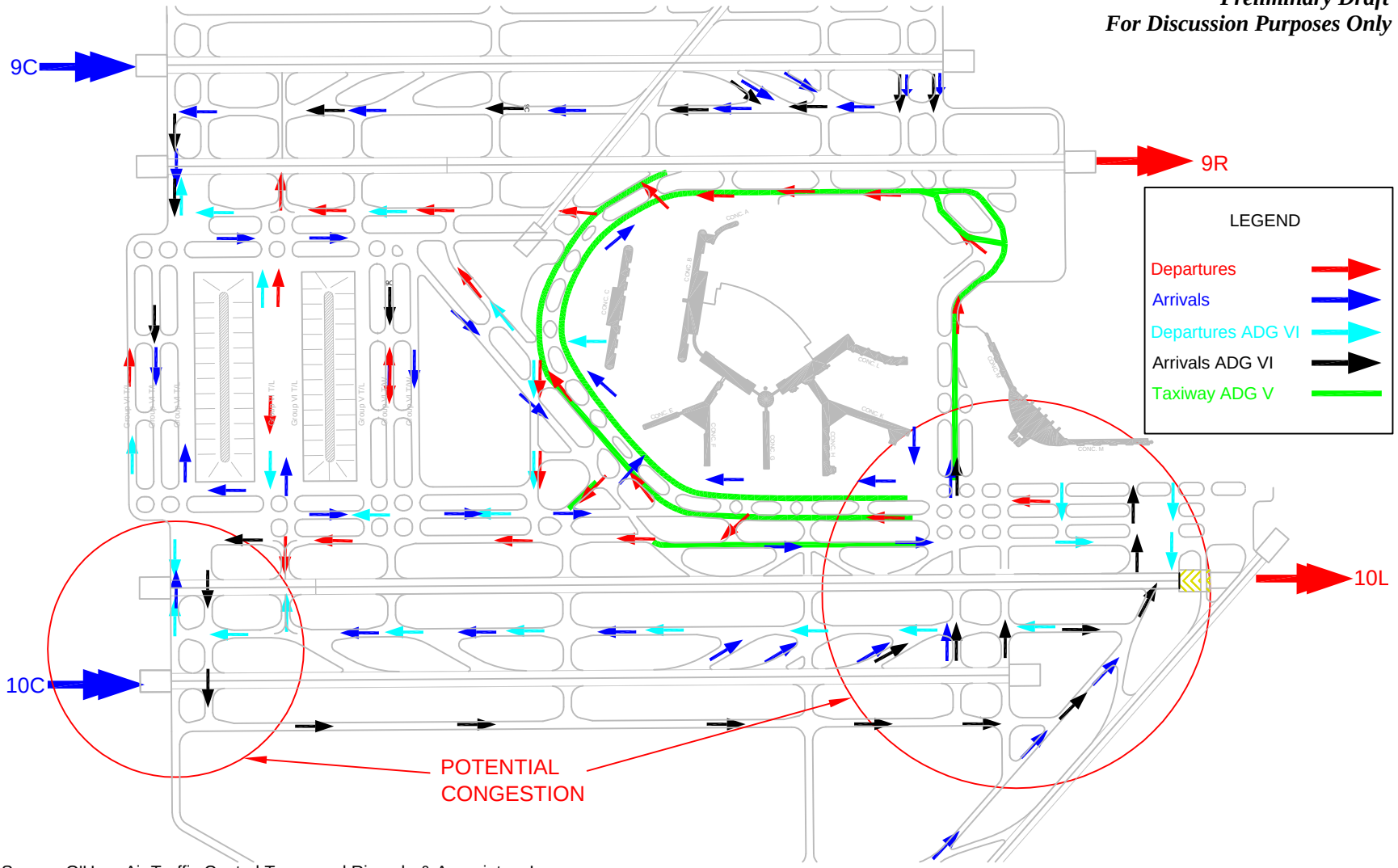
Source: O'Hare Air Traffic Control Tower and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

Exhibit IV-4

0 2000
north

IFR-East-Flow.dwg

IFR EAST FLOW



Source: O'Hare Air Traffic Control Tower and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

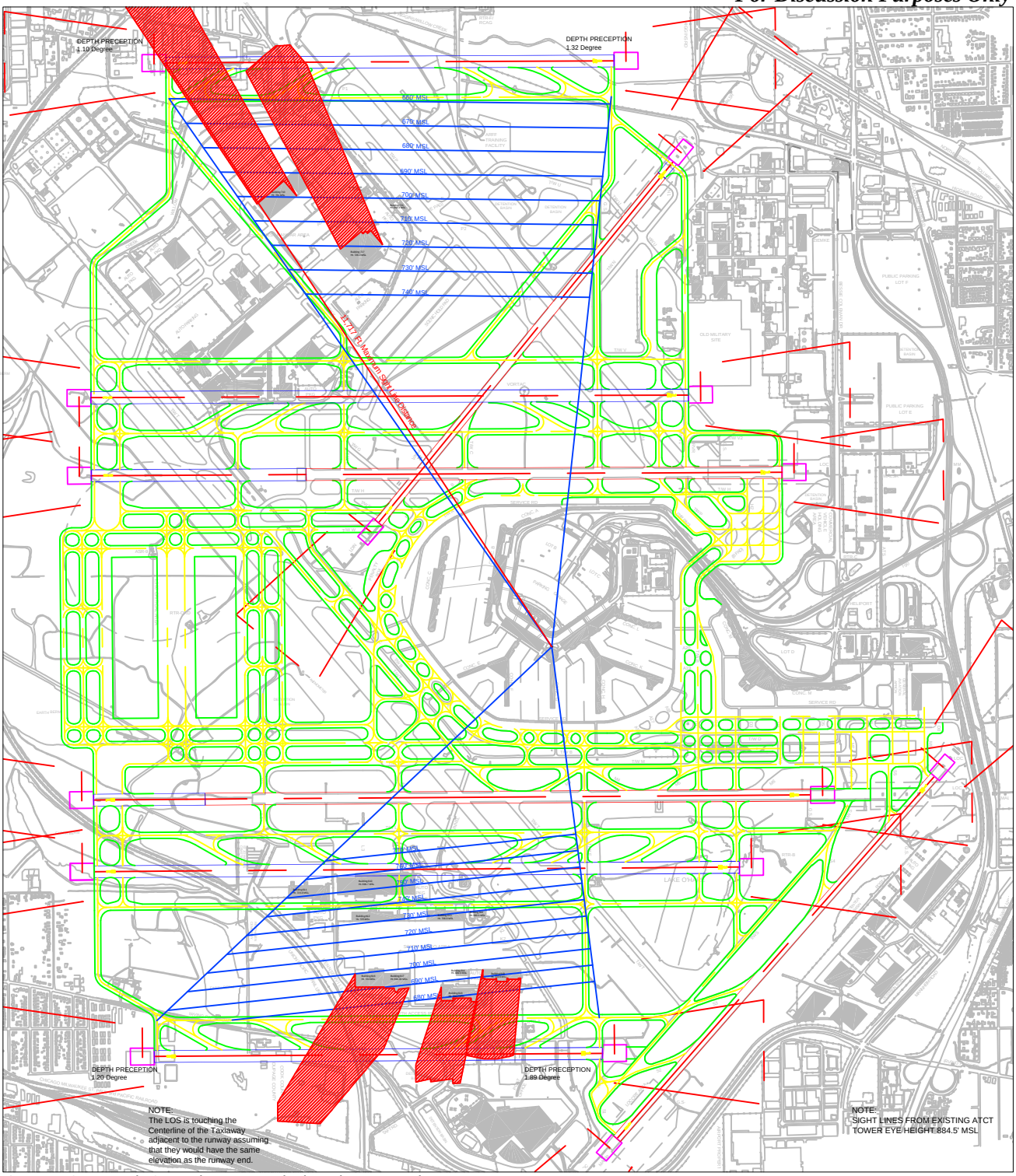
Exhibit IV-4A

0 2000

north

IFR-East-Flow.dwg

IFR EAST FLOW



Source: O'Hare Air Control Tower and Ricondo & Associates. Inc.
Prepared by: Ricondo & Associates, Inc.

Exhibit IV-5

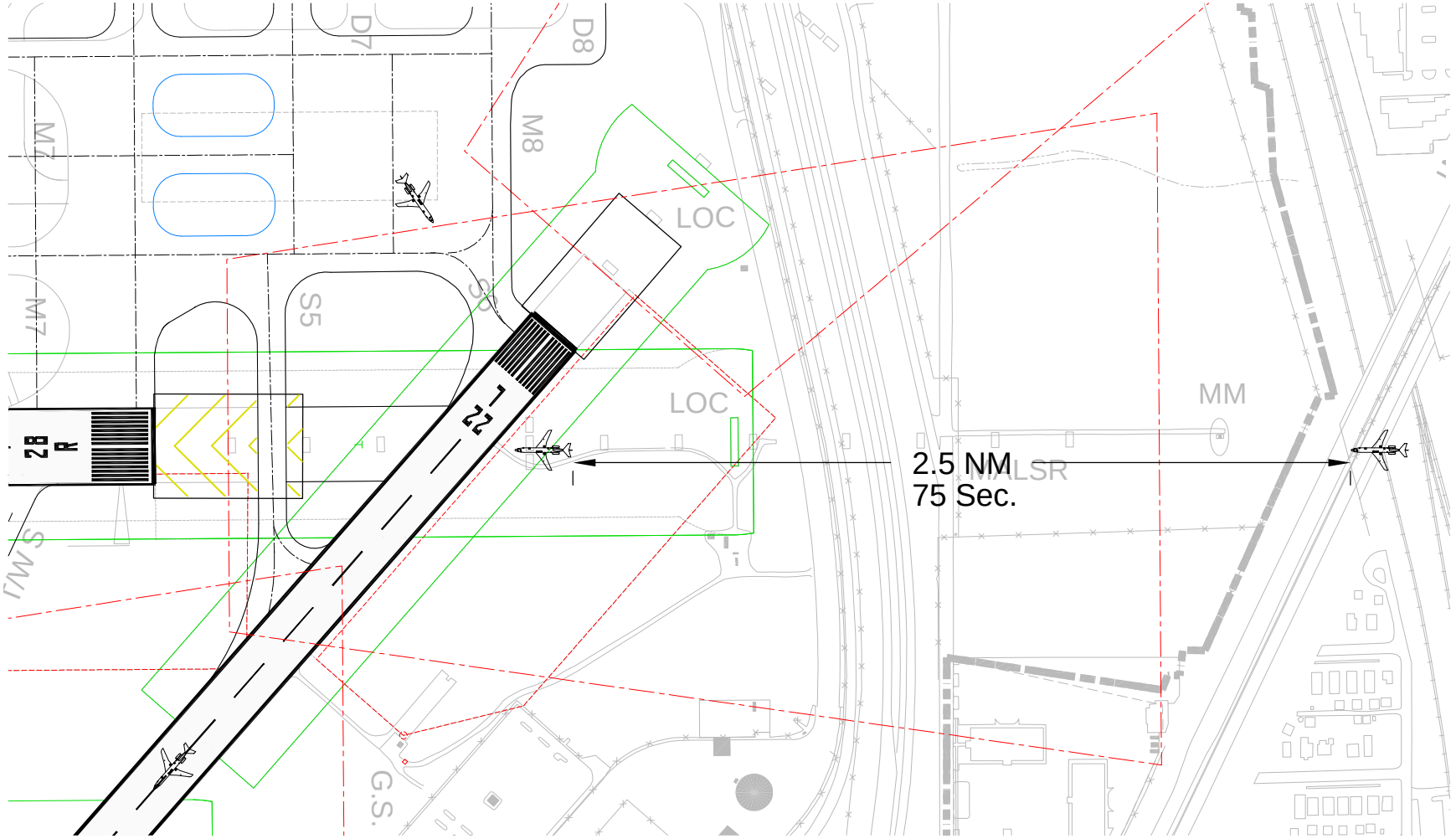
0 2500 ft.

north

O'Hare Existing ATCT Line-of-Site & Building Shadows OMP - Option 5

Z:/Chicago/ORD/OMP/Advisory Session/Materials/LOS-ATCT-Contours06-22-02.dwg

June 25, 2002



Source: O'Hare Air Traffic Control Tower and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

Exhibit IV-6

Not to Scale

north

Runway 22L Extension

Z:/Chicago/ORD/OMP/Advisory Sessions/Materials/6-25-02/RWY-22L-Ext.dwg

Exhibit IV-7

CAT II Wind Coverage

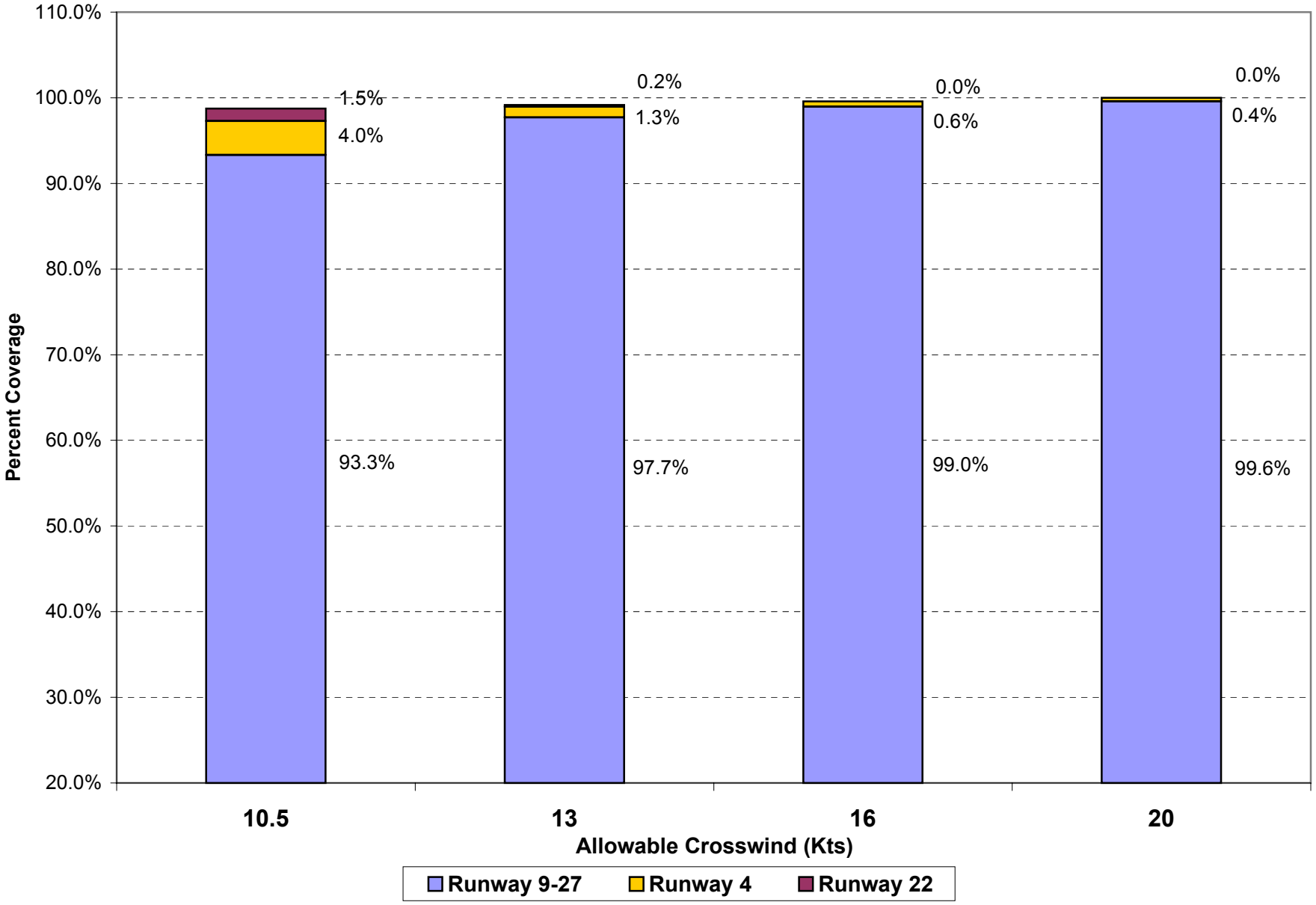


Exhibit IV-8
CAT III Wind Coverage